

Practitioner Certification for Photovoltaic System Installers

B. Martin, J. Dunlop, G. Ventre
Florida Solar Energy Center
1679 Clearlake Road
Cocoa, Florida 32922-5703

ABSTRACT

Practitioner certification is a credential awarded to the practitioner indicating that core competency standards have been met. Meeting these core standards requires an assessment of the practitioner's knowledge, skill and experience. There are many different processes that may be used in assessing competency and certifying practitioners. This paper discusses not only an accepted process for certification, but also specific recommendations on certification requirements, standards, testing, education and training that apply to those practitioners responsible for the installation of grid-tied photovoltaic systems [1].

1. The Need for Product Assurance

The photovoltaic industry has established ambitious goals for grid-tied photovoltaic system markets. These goals and projected markets are documented in *Solar Electric Power: The U.S. Photovoltaic Industry Roadmap*. Such markets must be built on high quality products that meet or exceed customer expectations. Certification programs, both hardware and practitioner, can help assure customers that the photovoltaic products they purchase will meet their expectations.

A question that is increasingly being asked is whether grid-tied photovoltaic systems are ready for widespread marketing and subsidy programs or, conversely, can industry adequately meet this rapidly growing demand. Certainly photovoltaic module manufacturers are well established, produce highly reliable products, and are rapidly adding new capacity to satisfy demand. Inverter and other major component suppliers are not as far along. The part of the industry responsible for installing grid-tied systems is diverse, ranging from highly competent engineering firms to individuals with hardly any knowledge of electrical circuits and inadequate skills and experience. Also, increasing demand has outstripped the availability of skilled practitioners with interest in grid-tied residential applications of photovoltaics.

To adequately address product assurance needs, the components that make up the photovoltaic system must meet safety, performance, reliability, durability and lifetime expectations. Likewise, the system design must be appropriately documented, incorporate accepted design practices, and comply with the most recent version of the *National Electrical Code*®. And, finally, the installation

must comply with all local electrical and building codes, function properly, and pass acceptance tests. This paper focuses on the quality assurance aspects associated with the installation of the system and, in particular, the competency of the practitioner responsible for the installation.

2. Classifying Photovoltaic Practitioners

In establishing recommendations for practitioner certification, three separate classifications of practitioners were defined: *designers*, *installers* and *inspectors* (code officials).

The function of the *design practitioner* is to select, size and configure all components into a compatible arrangement that constitutes the system design. As such, the function of the photovoltaic system designer is totally consistent with the design function of systems engineering in general. The end product of this function is a well-documented design that, on paper, complies with the latest version of the *National Electrical Code* and is consistent with industry-accepted design practices. The design documentation should include all relevant information that the installer practitioner needs to do his/her job.

The function of the *installer practitioner* is to adapt the design to meet specific customer and site needs, and to safely install and check out the system. The end product is a system that works properly and complies with all applicable local codes.

The function of the *inspector practitioner* is to ensure that the installation practitioner has completed a photovoltaic system installation that complies with all local electrical and building codes. Also, like the installation practitioner, the inspector practitioner depends upon the documentation of the system design in performing his/her function. However, the primary concern of the code official is safety – not system functionality. Of the three defined practitioner categories, the inspector practitioner is the only one whose primary function is quality control and that is for safety and installation practices.

Although this paper only addresses the certification of installation practitioners in detail, it is important to note the interdependency of the three categories and how their functions dovetail with each other.

3. Seven Components of a Practitioner Certification Program

Certification programs have seven primary steps that must be addressed to create a certification program. These seven steps can be categorized into three primary areas:

- *Requirements and Standards:* Establishing requirements; Setting standards; and Developing program tests.
- *Training and Education:* Identifying preparation and remediation options.
- *Logistics:* Governance; Administration, public relations and communications.

In this paper, we address the first two broad categories, *Requirements and Standards* and *Training and Education*. The *Logistics* area is critically important and is typically addressed by a board of directors. The board ensures that the certification requirements and standards are fairly and properly applied. Their decisions are dependent upon the established requirements and standards.

4. Establishing Requirements for Certification

The proposed requirements for practitioner certification include the following: 1) satisfying entry requirements, which consist of two years of experience, signing a code of ethics, and paying a fee, 2) passing a knowledge-based test that requires certification candidates to apply their knowledge of photovoltaic systems to typical situations they may face on the job, 3) passing a performance skills tests that requires candidates to demonstrate physical skills, 4) satisfactorily installing at least three photovoltaic systems (referred to as work samples), and 5) maintaining their certification by taking at least 12 contact hours of continuing education related to photovoltaic systems over a period of three years. It is also being proposed that completion of the first two requirements results in provisional certification and Completion of all five requirements results in full certification.

The requirements discussed above have been recommended to the North American Board of Certified Energy Practitioners (NABCEP) and are currently under review.

5. Setting Practitioner Certification Standards

Setting certification standards begins with developing a *task analysis*. A task analysis is a list of all core knowledge and skills that a practitioner must have to install a photovoltaic system. Each task is then given a priority ranking (high, medium, low) indicating how critical each task is in terms of 1) the likelihood of a practitioner making an error and 2) the seriousness of the error in the installation process. The task list and rankings, coupled with the conditions under which the task is performed and the criteria for performing the task, are the *standards* proposed at this time.

These standards have been recommended to NABCEP and are currently under review.

6. Testing for Competency

Based on the standards and the requirements for meeting those standards, competency tests are developed [2, 3]. As stated in the requirements, three tests have been proposed for PV practitioners: 1) an application-based knowledge test, 2) a performance skills test, and 3) the evaluation of three work samples. All tests are based directly on the task analysis. The knowledge test consists of 80 test items where candidates are required to apply knowledge of PV systems to situations they are likely to face on the job. The performance skills tests and the work samples require the use of criterion-referenced checklists. These checklists define critical skills required of the candidate. Trained evaluators judge the adequacy of the performance skills and the work samples based on specific criteria that have been established.

Test items and checklists are currently being developed and are under review for their validity and reliability.

7. Educating and Training Practitioners

While it is not required that candidates for PV certification take a PV training courses, it is expected that many will. Certification programs define options for training and remediation. These options are based on the knowledge and skills specified in the task analysis. Candidates who want to take a PV course can do so with some assurance that the knowledge and skills required to pass the certification tests will be addressed in the education and training courses.

A separate but related component of a certification program is the existence of *accredited* training courses and programs. While not addressed here, accredited training and education programs must meet specific standards set by an accrediting body. These standards are based, in part, on the same task analysis adopted by the certification program.

8. References

- [1] Hale, J. (2000). *Performance-based Certification: How to Design a Valid, Defensible, Cost-effective Program*. San Francisco: Jossey-Bass.
- [2] Hale Associates. (1996). *Workbook and Job Aids for Designing Good Fair Tests*. Downers Grove, IL.
- [3] Shrock, S. A., & Coscarelli, W. C. C. (1996). *Criterion-referenced Test Development: Technical and Legal Guidelines for Corporate Training and Certification*. The International Society for Performance Improvement.